

# Spectral and spatial near-field radiative transfer analysis in nature-inspired golden spiral nanostructures

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In the near-field regime of radiative transfer (NFRT), where the physical dimensions and separation spaces between geometries become less than or comparable to the thermal wavelength of emission, the evanescent surface waves become the dominant carriers of electromagnetic modes. In the close proximity of objects, these evanescent waves, which are confined to the surfaces, can transport thermal energy to a degree that exceeds the classical predictions [1–3]. In recent years, a significant amount of research has been devoted to theoretical, numerical and experimental investigations of radiative transfer in the near-field regime with various applications such as energy harvesting and radiative cooling, among others. In this work, we investigate NFRT in a golden spiral nanostructure. The golden spiral is a nature-inspired, mathematically defined geometry which can be found in galaxies, animals, and human fingerprint, to name only a few. Here, we present a computational work, based on finite difference time domain method and evaluated by the NF-RT-FDTD algorithm [4] where we investigate the spectral and spatial behavior of the local density of states and near-field radiative heat flux in a SiC golden spiral nanostructure. The results show that additional spectral peaks occur within the *reststrahlen* band of SiC. This observation suggests that the spatial position of the source of excitation as well as the local point where the fields are obtained are factors that could be tuned to achieve desired spectral functionality in quasi-periodic or aperiodic structures which may find applications in nano-scale energy harvesting.

## References

- [1] G. Chen, 2005: *Nanoscale Energy Transport and Conversion*, Oxford University Press.
- [2] J. R. Howell, M. P. Mengüç and R. Siegel, 2016: *Thermal Radiation Heat Transfer*, CRC Press.
- [3] Z. M. Zhang, 2007: *Nano/Microscale Heat Transfer*, McGraw-Hill.
- [4] A. Didari, and M. P. Mengüç, 2017: A design tool for direct and non-stochastic calculations of near-field radiative transfer in complex structures: the NF-RT-FDTD algorithm. *J. Quant. Spectrosc. Radiat. Transfer* **197**, 95–105.

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